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| 10/584,053 | 06/22/2006 | Frederic Mazen | 292759US0PCT | 4625 |
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| OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, P.C. 1940 DUKE STREET ALEXANDRIA, VA 22314 | | | | |
| EXAMINER | | | | |
| MILLER, JR, JOSEPH ALBERT | | | | |
| ART UNIT | | PAPER NUMBER | | |
| 1792 | | | | |
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary

Application No.

10/584,053

Applicant(s)

MAZEN ET AL.

Examiner

JOSEPH MILLER JR

Art Unit

1792

Period for Reply -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 08 February 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,3,4,6-11 and 13-25 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,3,4,6-11 and 13-25 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/S508)
- Paper No(s)/Mail Date 10/03/2008
- 4) ☐ Interview Summary (PTO-413)
- Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Priority

Because applicant has not perfected priority by supplying an English language translation of 0351186 (French application), it can not be determined if the disclosure of the prior-filed application, Application No.0351186, provides adequate support or enablement in the manner provided by the first paragraph of 35 U.S.C. 112 for one or more claims of this application. Therefore, the effective filing date for the instant claimed subject matter is deemed to be December 21, 2004.

Claim Observations

Claims 1 and 17 recite the limitation "by the irradiation of a substrate by means of a beam of ions, by localized deposition of atoms suitable for the formation of such sites". In reading of this claim as required for examination, i.e. broadly, the use of irradiation is required as a step in the formation of the nucleation sites, but as written the irradiation is not a required **deposition** step.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 6 recites the limitation "said semiconductor material". There is insufficient antecedent basis for this limitation in the claim.

For purposes of examination, the "said semiconductor material" will be treated the same as applied by applicants in claim 17, forming "structures in a semiconductor material".

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-4, 6-14, and 17-23 are rejected under 35 U.S.C. 102(e) as being anticipated by Islam (2005/0133476).

Islam teaches the controlled growth of nanowires (abstract). Islam teaches the preparation of a Si substrate using patterning by ion beam etching [0046-0047] and the deposition of a catalyst (nucleation site) by a deposition method [0053-0054] in a manner that may include preferential (i.e. localized) deposition of the catalyst in particular areas of the substrate [0055]. Nanowires are then grown via CVD by a gas

such as dichlorosilane [0071]. The nanowires that Islam teaches are clearly in three dimensions (they grow from a 111 plane, which denotes three dimensions, [0034]). The nucleation sites inherently contain atoms of material (that have been deposited).

Regarding claims 3, 4, 6, 17 and 18, the substrate is silicon, a semiconductor/dielectric material.

Regarding claims 7 and 20 the nanowires are formed of silicon by dichlorosilane.

Regarding claim 8 and 19, silicon is a IV type material.

Regarding claim 9, Islam teaches the formation of nanowires of silicon carbide [0033].

Regarding claims 10 and 21, Islam teaches the formation of nanowires including elements from group III and V [0033].

Regarding claims 11 and 22, Islam teaches the formation of nanowires including GaAs, GaP or GaN [0033].

Regarding claim 13, the nanowires that Islam teaches are clearly in three dimensions (they grow from a 111 plane, which denotes three dimensions, [0034]).

Regarding claims 14 and 23, the nanowires taught by Islam are between 1 and 100 nm in diameter, thereby teaching on instant range [0006].

Claims 1, 3, 6, 8, 10, 13, 15, 17 – 19, 21 and 24 are rejected under 35 U.S.C. 102(b) as being anticipated by Lee (2003/0104888).

Lee teaches a method of forming silicon cone arrays with silicon oxide nanowires on the tips (abstract). Lee teaches that the silicon cones (nucleation sites for the wires)

are formed by ion beam sputtering [0037, 0038] localized at the substrate surface. The nanowires are then formed on the cones by CVD [0044]. A "cone", which is comprised of atoms, is a three dimensional shape.

Regarding claims 3, 6, 18 and 19 the substrate may be silicon or germanium, dielectric materials.

Regarding claims 8, 10 and 21, silicon is a type IV material.

Regarding claims 13 and 17, it is inherent that a "cone" is a 3-dimensional shape.

Regarding claims 15 and 24, Lee teaches the formation of cones (nanostructure nucleation sites) that are in a density of $10^8/\text{cm}^2$. While Lee is silent on the density of the nanowires grown on the cones, it would be inherent that the density would be of the same order of magnitude, being that the nanowires are grown directly onto the tips [0044].

Claims 1, 3, 17 and 18 are rejected under 35 U.S.C. 102(b) as being anticipated by Schlaf (2003/0157744).

Schlaf teaches a process for the formation of nucleation sites [0013] for the growth of carbon nanotubes [0012] in a plurality of locations using FIB deposition [0014]. The nucleation sites are then subjected to CVD to grow the carbon nanotubes [0013]. The use of the FIB inherently allows deposition of "atoms" of material.

Regarding claims 3 and 18, the substrate is a gate oxide, which is well known in the art to be a dielectric material (also known as gate dielectric).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 16 and 25 are rejected under 35 U.S.C. 103(a) as being anticipated by Islam (2005/0133476) as applied to claims 1 and 17 above, and in further view of Houge (2006/0231752).

Islam teaches the controlled growth of nanowires (abstract). Islam teaches the preparation of a Si substrate using patterning by ion beam etching [0046-0047] and the deposition of a catalyst (nucleation site) by a deposition method [0053-0054] in a manner that may include preferential (i.e. localized) deposition of the catalyst in particular areas of the substrate [0055]. Nanowires are then grown via CVD by a gas such as dichlorosilane [0071]. The nanowires that Islam teaches are clearly in three dimensions (they grow from a 111 plane, which denotes three dimensions, [0034]).

Islam is silent on the composition of the beam of ions used to treat the surface.

Houge teaches a system and method of using an ion beam for sample preparation [0145]. Hogue teaches the use of Si or Cu for milling [0145].

It would have been obvious to someone of ordinary skill in the art at the time of the invention to apply the use of a silicon (ion) beam to the ion beam treatment/nanowire growth method of Islam because of the exceptional milling properties of Si [0145].

Claims 7 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lee (2003/0104888) as applied to claims 1 and 17 above and in view of Sharma (2002/0076553).

Lee teaches a method of forming silicon cone arrays with silicon oxide nanowires on the tips (abstract). Lee teaches that the silicon cones (nucleation sites for the wires) are formed by ion beam sputtering [0037, 0038]. It is inherent in this process that the substrate is exposed to the ion beam, since the sputter material is re-deposited onto the substrate it must lie within the area impacted by the ion beam. (Additionally, the metal catalyst is physically mounted to the substrate and therefore becomes part of the substrate). The nanowires are then formed on the cones by CVD [0044].

Lee teaches that the substrate may be germanium, but does not specifically teach the formation of germanium nanowires.

Sharma teaches that germanium fibers ("nanowires" [0004]) may be grown using germane in the vapor phase or the exposure of a germanium substrate to hydrogen gas [0008, 0022]. The hydrogen gas exposed to the germanium substrate then creates vapor germane, which deposits to form germanium fibers [0022].

It would have been obvious to someone of ordinary skill in the art at the time of the invention that applying the hydrogen gas as taught in the CVD nanowire growth process of Lee [0044] would form nanowires from germane precursor that is created in the CVD process. Instant claim does not require a germane (or dichlorosilane) gas to be supplied to the reactor from an external source).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Komano (5,083,033) teaches a process where a silicon compound is applied to specific areas of a substrate by FIB.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOSEPH MILLER JR whose telephone number is (571) 270-5825. The examiner can normally be reached on Monday through Thursday from 8am to 4pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks, can be reached on 571-272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/JOSEPH MILLER JR/
Examiner, Art Unit 1792

/Timothy H Meeks/
Supervisory Patent Examiner, Art Unit 1792

